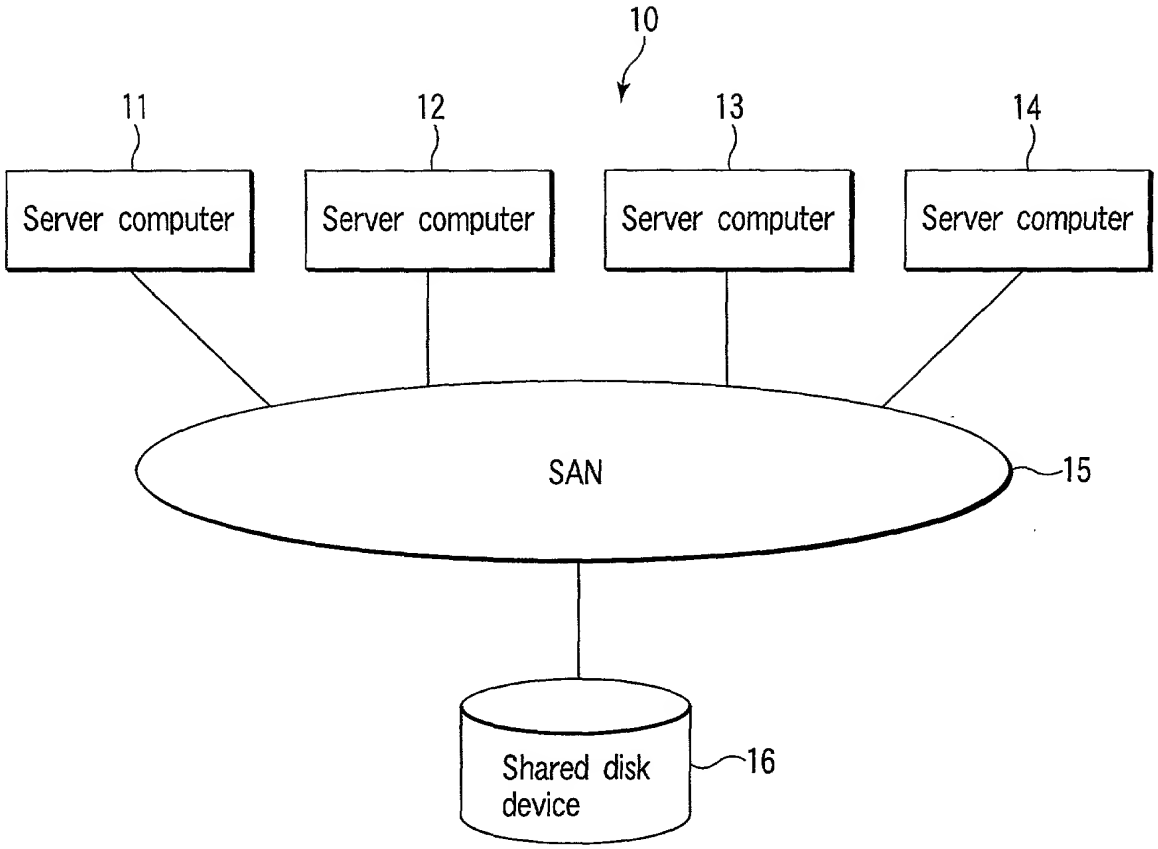

10
11
12
13
14
Server computer
Server computer
Server computer
Server computer
SAN
15
Shared disk device
16

FIG. 1

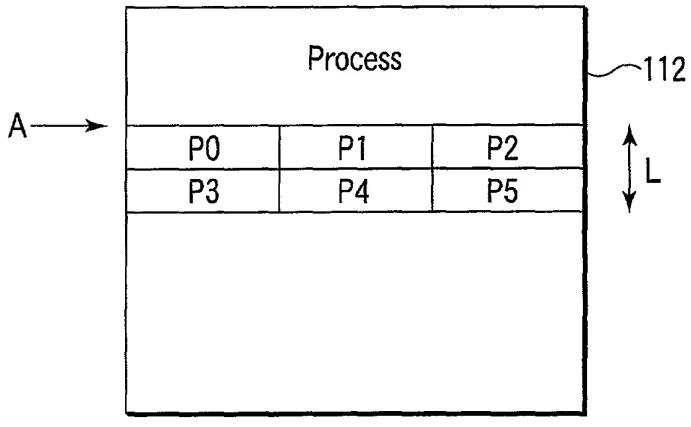

Process
112
A
P0
P1
P2
P3
P4
P5
L

FIG. 3

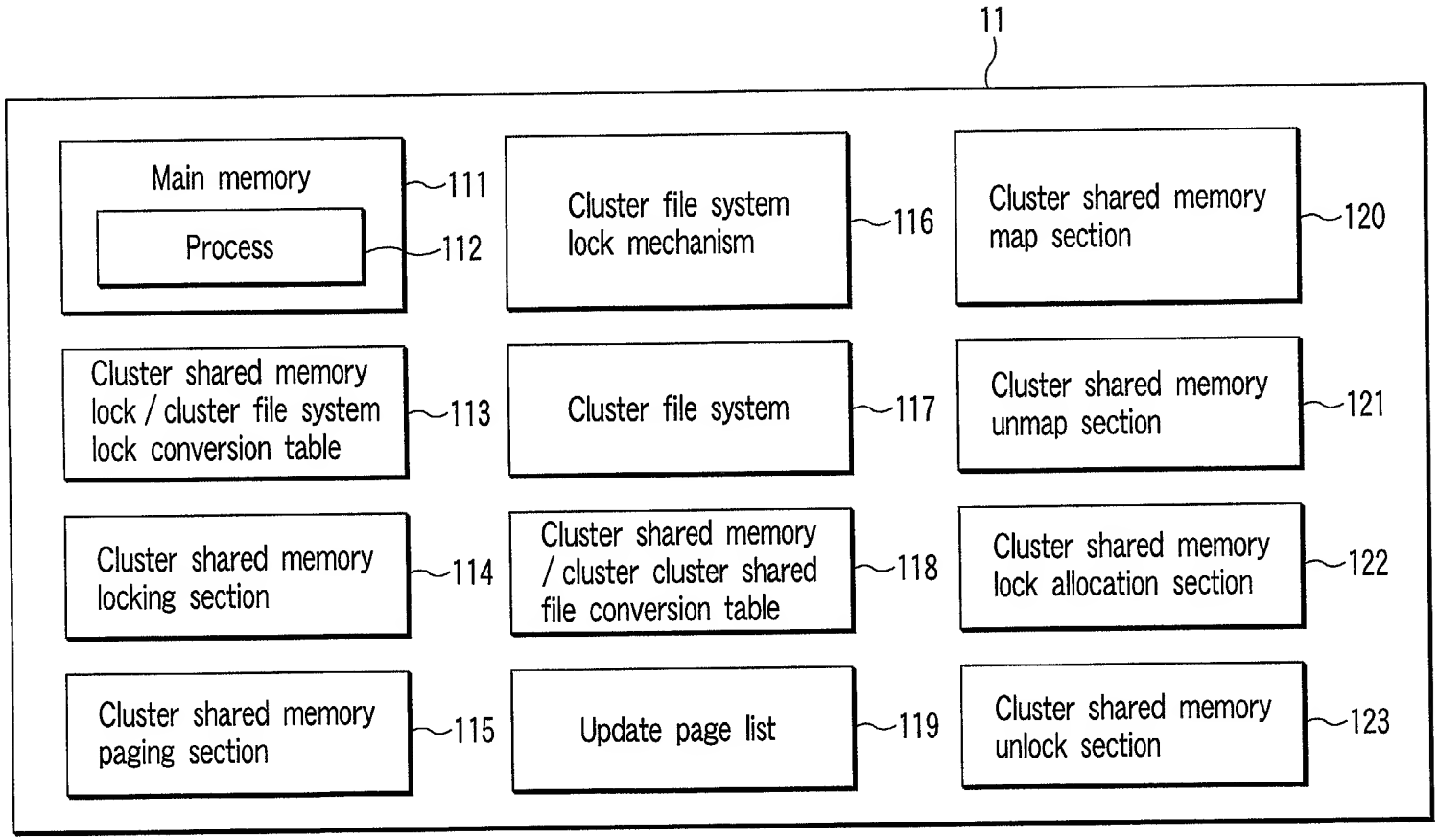

11
Main memory
Process
111
112
Cluster file system lock mechanism
116
Cluster shared memory map section
120
Cluster shared memory lock / cluster file system lock conversion table
113
Cluster file system
117
Cluster shared memory unmap section
121
Cluster shared memory locking section
114
Cluster shared memory / cluster cluster shared file conversion table
118
Cluster shared memory lock allocation section
122
Cluster shared memory paging section
115
Update page list
119
Cluster shared memory unlock section
123

FIG. 2

FIG. 4

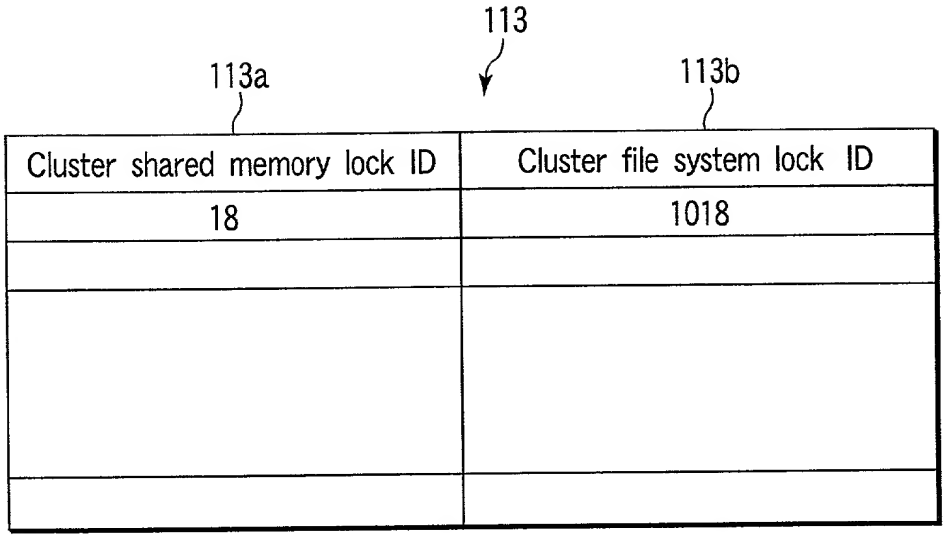


FIG. 5

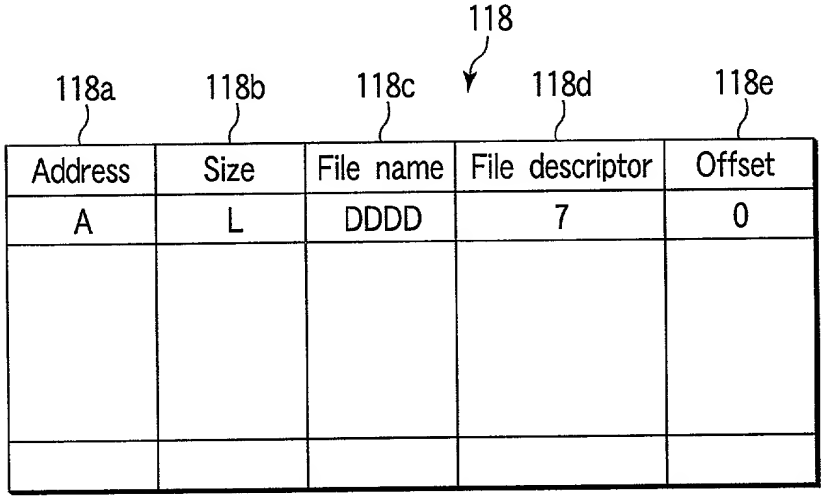
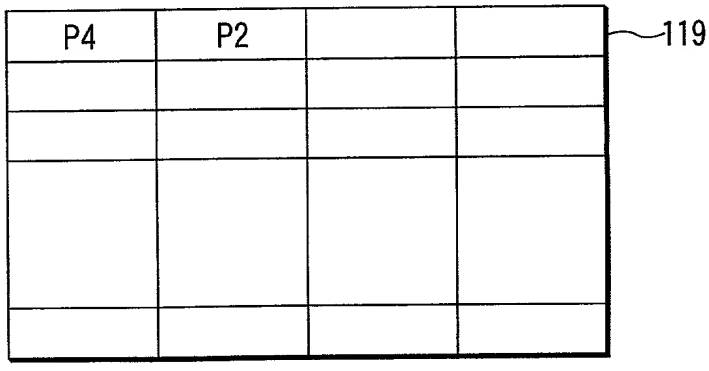
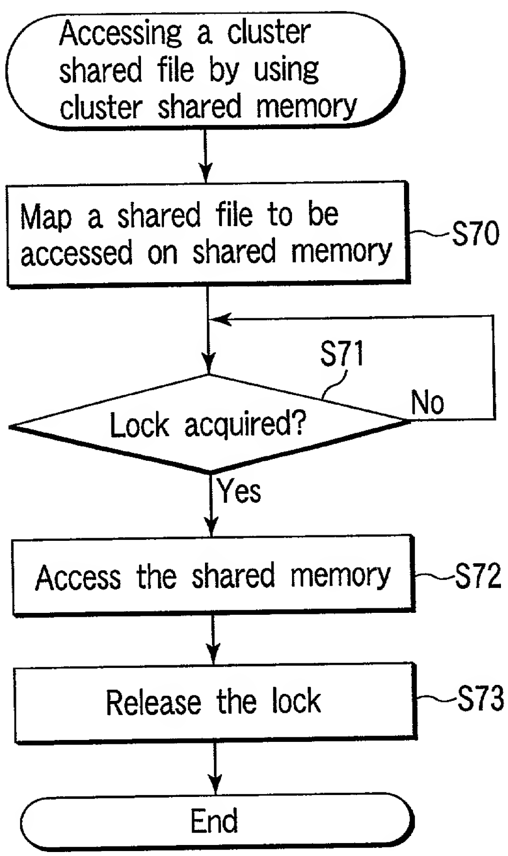
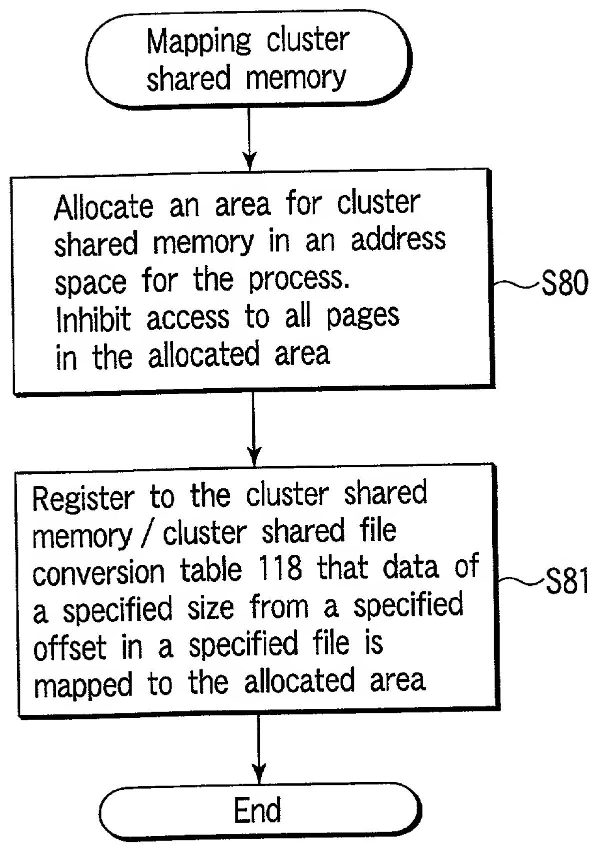


FIG. 6




Accessing a cluster shared file by using cluster shared memory
Map a shared file to be accessed on shared memory
S70
S71
Lock acquired?
No
Yes
Access the shared memory
S72
Release the lock
S73
End

F I G. 7


Mapping cluster shared memory
Allocate an area for cluster shared memory in an address space for the process. Inhibit access to all pages in the allocated area
S80
Register to the cluster shared memory / cluster shared file conversion table 118 that data of a specified size from a specified offset in a specified file is mapped to the allocated area
S81
End

F I G. 8

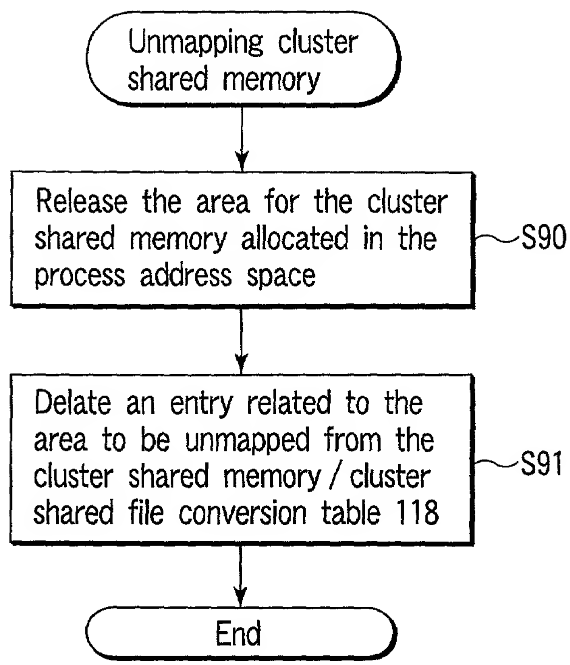

Unmapping cluster shared memory
Release the area for the cluster shared memory allocated in the process address space
S90
Delate an entry related to the area to be unmapped from the cluster shared memory / cluster shared file conversion table 118
S91
End

FIG. 9

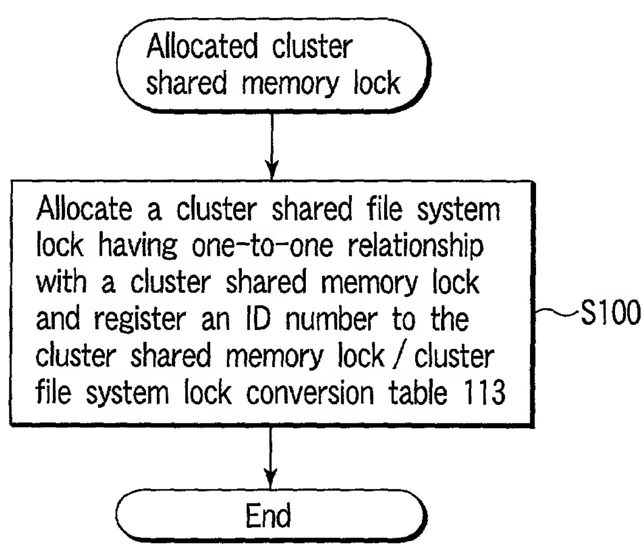
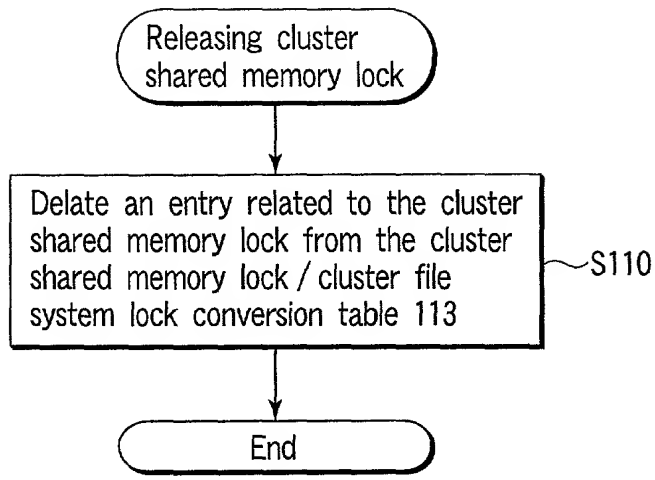
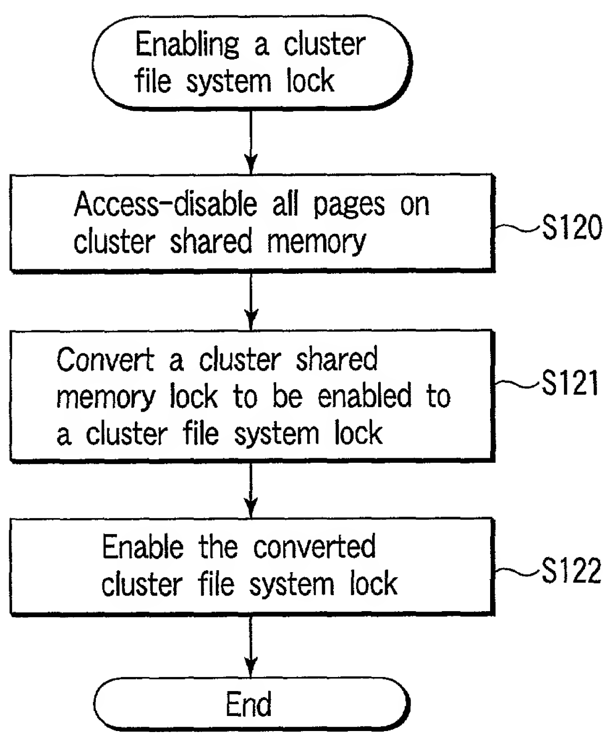

Allocated cluster shared memory lock
Allocate a cluster shared file system lock having one-to-one relationship with a cluster shared memory lock and register an ID number to the cluster shared memory lock / cluster file system lock conversion table 113
S100
End

FIG. 10


Releasing cluster shared memory lock
Delate an entry related to the cluster shared memory lock from the cluster shared memory lock / cluster file system lock conversion table 113
S110
End

F I G. 11


Enabling a cluster file system lock
Access-disable all pages on cluster shared memory
S120
Convert a cluster shared memory lock to be enabled to a cluster file system lock
S121
Enable the converted cluster file system lock
S122
End

F I G. 12

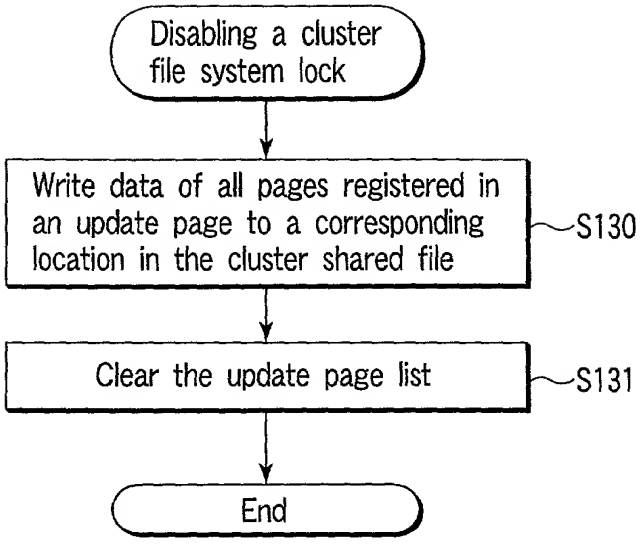


FIG. 13

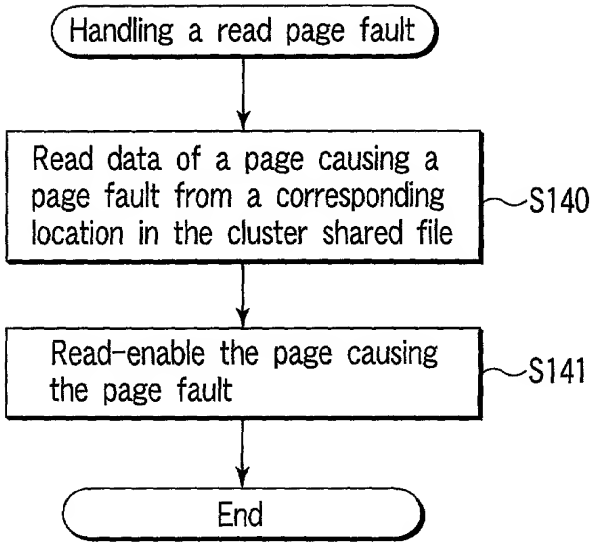


FIG. 14

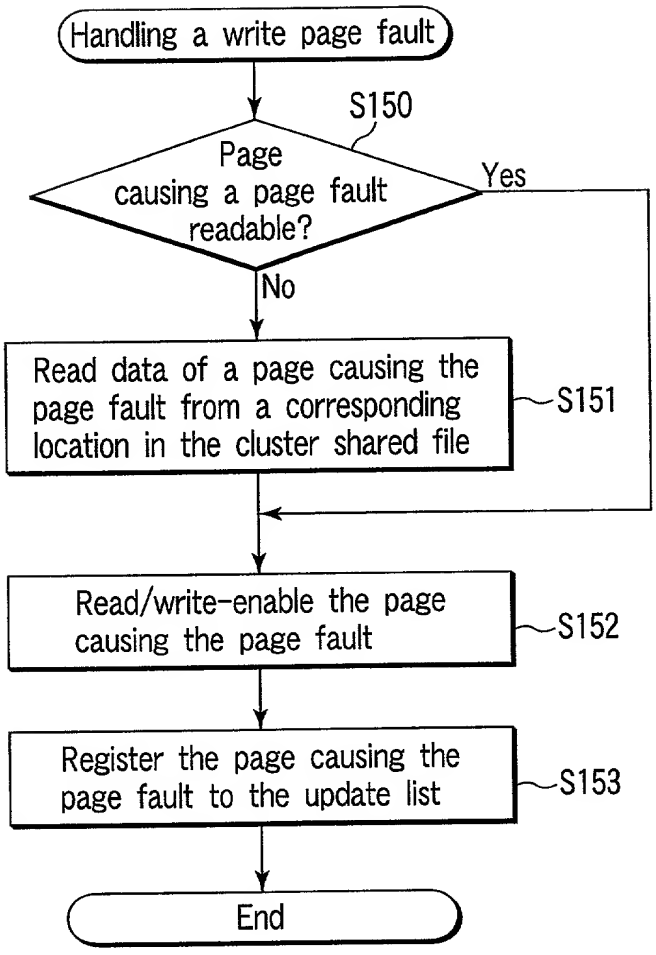

Handling a write page fault
S150
Page causing a page fault readable?
Yes
No
Read data of a page causing the page fault from a corresponding location in the cluster shared file
S151
Read/write-enable the page causing the page fault
S152
Register the page causing the page fault to the update list
S153
End

FIG. 15

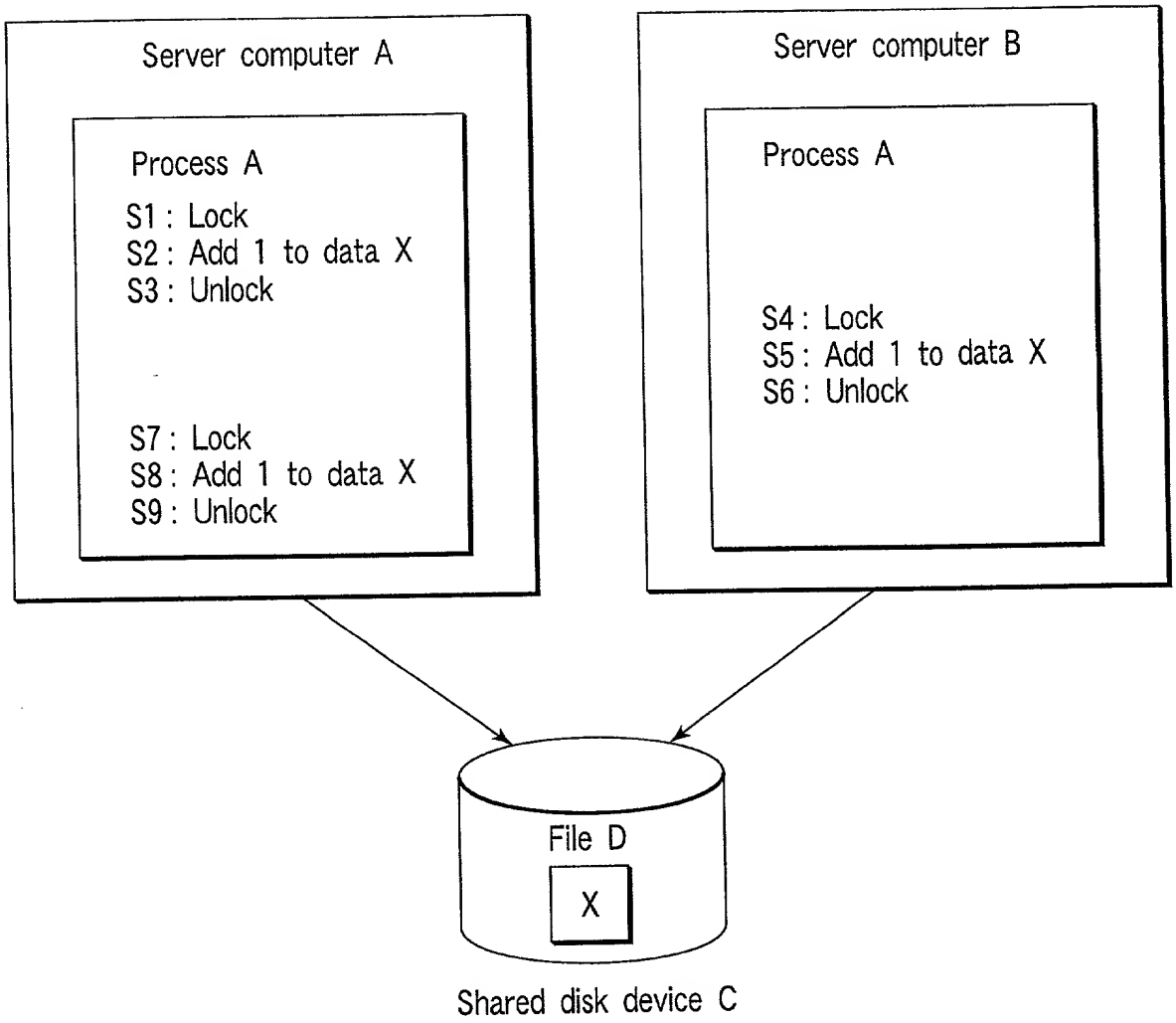

Server computer A
Process A
S1 : Lock
S2 : Add 1 to data X
S3 : Unlock
S7 : Lock
S8 : Add 1 to data X
S9 : Unlock
Server computer B
Process A
S4 : Lock
S5 : Add 1 to data X
S6 : Unlock
File D
X
Shared disk device C

FIG. 16